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INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB 03/05598	International filing date (day/month/year) 19.12.2003	Priority date (day/month/year) 19.12.2002
International Patent Classification (IPC) or both national classification and IPC H04L29/06		
Applicant COGNIMA LTD et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
- These annexes consist of a total of 6 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 15.07.2004	Date of completion of this report 25.04.2005
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**INTERNATIONAL PRELIMINARY
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International application No. PCT/GB 03/05598

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1, 4-49	as originally filed
2, 3	received on 31.03.2005 with letter of 25.03.2005

Claims, Numbers

4-27	received on 10.02.2005 with letter of 01.02.2005
1-3	received on 31.03.2005 with letter of 25.03.2005

Drawings, Sheets

1/2-2/2	as originally filed
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2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

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5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

see separate sheet

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-27
	No: Claims	
Inventive step (IS)	Yes: Claims	20-24
	No: Claims	1-19,25-27
Industrial applicability (IA)	Yes: Claims	1-27
	No: Claims	

2. Citations and explanations

see separate sheet

Re Item I

Basis of the report

The amendments filed with letter of 25.03.2005 received on 31.03.2005 go beyond the disclosure in the international application as filed (Article 34(2)(b) PCT). The amendments concerned are the following:

1.) page 2 lines 13-15: "To evaluate whether a given message should be transmitted would require specific algorithms to be run relating to each criteria and potentially complex priority clashes to be resolved."

The problem cited in the abovementioned passage is neither disclosed in the application as originally filed nor in the prior art document referred to.

2.) page 3 lines 21-23: same as under point 1.)

3.) page 3 lines 23-27: "But with the present invention, different criteria are not individually evaluated, but instead an abstract entity called 'weight' is used; 'weight' can model any and all criteria. Evaluation is far quicker and more efficient since it can be simply a matter of comparing a single 'weight' value against a threshold value;"

The application mentions the use of several weights rather than "a single one" (page 15 line 15-page 16 line 5, "default weight" and "oversize weight"), from which one or the other is selected based on a first threshold ("size limit" threshold). Subsequently, the selected weight is compared to a second threshold ("changelog threshold") (page 16 lines 6-23). The comparison of only one weight value with only one threshold value is not disclosed in the application as originally filed.

The present report is therefore established as if the addition of the aforementioned passages had not been made.

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1 Reference is made to the following documents:

D1: WO 01/78319 A (RES IN MOTION LTD ;VANDER VEEN RAYMOND (CA);
CASTELL DAVID (CA); L) 18 October 2001
D2: EP-A-0 794 646 (IBM) 10 September 1997

2 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 does not involve an inventive step in the sense of Article 33(3) PCT.

The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses, in terms of claim 1 (the references in parentheses applying to this document):

a method of automatically replicating data objects between a mobile device and a server, connected together via a wireless network, in which the timing of data replication across the network is determined by a network operator applying parameters that make efficient usage of network bandwidth (page 47 line 14-page 53 line 24), in which:

i) a change log (page 48 line 31-page 49 line 6 "database 1950"; page 51 lines 5-17 "storage area 1970") lists all objects at the device and/or server to be replicated and the parameters then comprise a weight associated with each object that defines how urgently that object needs to be replicated (page 49 lines 5-17, "criteria", "configuration parameters", "received network parameters"; page 51 lines 15-22, "delivery rules"); and
ii) the parameters further comprise a threshold that is a function of time (implicitly disclosed, see below), with the weight of each object being locally compared to the threshold at a given time (page 52 lines 20-22) and the outcome of the comparison determining whether the object is sent for replication or not at that time.

The subject-matter of claim 1 therefore differs from the method disclosed in D1 in

that all the criteria that are relevant to how urgently an object needs to be replicated are represented by a single weight associated with that object.

The problem to be solved by the present invention may therefore be regarded as how to decide to replicate an object in case there are conflicting criteria that apply at the same time.

The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

Document D1 already mentions a plurality of criteria that can be taken into account (D1, page 49 lines 5-17, "criteria", "configuration parameters", "received network parameters"; page 51 lines 15-22, "delivery rules"). Document D1 also hints at using more than one criterion at the same time: "a wide range of criteria" (page 49 line 5) and "based on certain criteria" (page 51 line 1). Some of the criteria mentioned are conflicting, for example maximum message size on one hand and specific type of message / content identifier / destination mobile address (i.e. an indication of urgency) on the other hand (page 49 lines 6-8, page 51 lines 19-21). The person skilled in the art, when confronted with the problem posed, would have to strike a balance between these conflicting criteria. It would be an obvious option to achieve this by combining them into a single weight that represents all the criteria that are relevant to how urgently an object needs to be replicated.

Concerning the implicit disclosure of the feature "threshold that is a function of time", it is pointed out that document D1 already discloses the feature of assigning a weight to a message (page 49 lines 5-9 and page 51 lines 15-26: "maximum message size, maximum time reached, specific type of message, destination address, a content identifier in the subject or body, a set of configuration parameters"). Document D1 also discloses the use of this weight ("certain criteria") to decide to send immediately or to delay the sending (page 52 lines 20-22, page 53 lines 21-24). To do so, the weight must be compared to some value, i.e. to an implicit threshold, for example the weight of "emails" and "calendar events" (page 53 line 22) is above the threshold, the weight of "folder moves" (page 53 line 23) below the threshold. At off-peak hours everything is sent immediately (page 52 line 22, page 53 line 23), which corresponds to setting the implicit threshold to zero.

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- 3 The same reasoning applies, mutatis mutandis, to the subject-matter of the corresponding independent claims 26 and 27, which therefore are also considered not inventive.
- 4 Dependent claims
- 4.1 Dependent claims 2-19 and 25 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty or inventive step, as those features are disclosed in documents D1 or D2 (see documents D1 and D2 and the corresponding passages cited in the search report) or are considered to be known to the person skilled in the art:
- the subject-matter of claims 2-4, 11-12, 18, 19 and 25 is known from D1;
 - the subject-matter of claim 6 is already known from D1: "delaying replication until non-peak times" (D1, page 52 line 22, page 53 line 23) anticipates "making efficient use of available bandwidth";
 - the subject-matter of claim 10 is already known from D1: the time variability of replication in D1 is included in the "threshold" which changes over time;
 - the additional features of claims 5, 7-9, 13-16 and 17 are obvious design features for the person skilled in the art, see also for example D2 for claims 13-15.
- 4.2 The subject-matter of claims 20 to 24 appears to satisfy the criteria of novelty, inventive step and industrial applicability, as defined in Article 33(2) to (4) PCT. The subject-matter of claims 20 to 24 differs from the method disclosed in document D1 in that an opportunism threshold function is used to determine the further objects to be sent once a connection initiating object has been replicated. The problem to be solved by the subject-matter of claim 20 may be regarded as how to determine which further objects to send. The technical feature of using an additional threshold ("opportunism" threshold) is neither known nor hinted at in the prior art.

D. Peeters
Examiner

of downloading these menus of games over night to make use of the available bandwidth.

To date, designers of data replication systems (as opposed to simple one-way push updating systems) have not been preoccupied with making efficient use of network bandwidth. This bias arises because the assumption behind most data replication systems is the need for immediate replication, irrespective of the impact on bandwidth.

Reference may be made to PCT/CA01/00486, which discloses a system for pushing messages from a message server to a mobile device and vice versa. Different criteria can be deployed to determine when messages are sent; (e.g. maximum message size, maximum time reached, specific type of message, destination address, content identifiers, time of day etc.). To evaluate whether a given message should be transmitted would require specific algorithms to be run relating to each criteria and potentially complex priority clashes to be resolved. Where evaluation occurs on a mobile device, with inevitable power constraints, the challenge is to minimise power consumption (e.g. processor cycles needed to complete a task).

SUMMARY OF THE PRESENT INVENTION

In a first aspect, there is a method of automatically replicating data objects between a mobile device and a server, connected together via a wireless network, in which the timing of data replication across the network is determined by a network operator applying parameters that make efficient usage of network bandwidth; in which:

(i) a change log lists all objects at the device and/or server to be replicated and the parameters then comprise a weight associated with each object that defines how urgently that object needs to be replicated; and

(ii) the parameters further comprise a threshold that is a function of time, with the weight of each object being locally compared to the threshold at a given time and the outcome of the comparison determining whether the object is sent for replication or not at that time;

characterised in that all criteria that are relevant to how urgently an object needs to be replicated are represented by a single weight associated with that object.

This combination of 'weight' and threshold gives a flexible way to control the timing of data replication and hence make the best use of bandwidth. Prior art approaches use many different criteria to determine whether a message can be sent (e.g. maximum message size, maximum time reached, specific type of message, destination address, content identifiers, time of day etc.). As noted above, to evaluate whether a given message should be transmitted would require specific algorithms to be run relating to each criteria and potentially complex priority clashes to be resolved. But with the present invention, different criteria are not individually evaluated, but instead an abstract entity called 'weight' is used; 'weight' can model any and all criteria. Evaluation is far quicker and more efficient since it can be simply a matter of comparing a single 'weight' value against a threshold value; because only a single weight criteria is ever compared to the time varying threshold, there are considerable speed and efficiency gains. Where evaluation occurs in a mobile device with inevitable power constraints, speed and efficiency are highly valuable attributes.

Further aspects and details are defined in the appended Claims.

CLAIMS

1. Method of automatically replicating data objects between a mobile device and a server, connected together via a wireless network, in which the timing of data replication across the network is determined by a network operator applying parameters that make efficient usage of network bandwidth; in which:

(i) a change log lists all objects at the device and/or server to be replicated and the parameters then comprise a weight associated with each object that defines how urgently that object needs to be replicated; and

(ii) the parameters further comprise a threshold that is a function of time, with the weight of each object being locally compared to the threshold at a given time and the outcome of the comparison determining whether the object is sent for replication or not at that time;

characterised in that all criteria that are relevant to how urgently an object needs to be replicated are represented by a single weight associated with that object.

2. The method of Claim 1 in which a connection is established at a given time if the weight of any object exceeds the threshold at that time.

3. The method of Claim 1 in which the weight of an object at a given time is a function of one or more of the following:

- (a) Direction of data replication (device to server or server to device)
- (b) Shelf life, defining the time or duration after which the object will be automatically deleted if still present in the change log
- (c) Whether the object is overwritable
- (d) Size in bytes
- (e) Time entered into the change log
- (f) Priority
- (g) Time out interval
- (h) Assigned time for replication
- (i) User assignment of a non-default priority to a given object
- (j) Memory available.

4. The method of Claim 1 in which the network operator can cause the weight of an object to be altered at any time.
5. The method of Claim 1 in which the network operator can cause the threshold to be altered at any time.
6. The method of Claim 1 in which the threshold varies over time in such a way that efficient use is made of available bandwidth.
- 10 7. The method of Claim 1 in which the threshold can vary over time in a different way for different groups of end-users, individual end-users or applications.
8. The method of Claim 1 in which dynamic varying of the threshold can occur as cell or network loadings change.
- 15 9. The method of Claim 1 in which dynamic varying of the threshold can occur to encourage uptake of a new data replication service.
10. The method of Claim 1 in which the threshold can vary depending on one or more of the following:
 - (a) current time
 - (b) device roaming status
 - (c) cell or network loading
 - (d) time since last replication
 - 25 (e) user tariff.
11. The method of Claim 1 in which, if the weight of no object exceeds the threshold at a given time, the time interval that will elapse before the weight of any object exceeds the threshold is calculated and a timer set for that time interval.
- 30 12. The method of Claim 11 in which the time interval is re-calculated if:
 - (a) a new object is added to the change log
 - (b) a new threshold is deployed

- (c) the timer expires
- (d) cell or network loading alters
- (e) device memory falls below a predefined level
- (f) the device detects that its roaming state changes
- 5 (g) a new application is activated on the device
- (h) a network connection is terminated.

13. The method of Claim 1 in which the end-user of the device can override default replication timing in respect of a specific object or type of object.

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14. The method of Claim 1 in which an object to be replicated is assigned a time limit by which time replication must occur.

15. The method of Claim 14 in which the time limit is dynamic.

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16. The method of Claim 14 in which the time limit alters if memory on the device changes or if the device roams to a new network

17. The method of Claim 1 in which an object to be replicated is assigned a shelf life which defines a time or duration after which the object will be deleted automatically if not replicated.

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18. The method of Claim 1 in which different parameters enable the network operator to offer end-users different levels of data replication service, each associated with a different tariff.

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19. The method of Claim 1 in which, once a connection initiating object has been replicated, then further objects in a change log and pending replication are sent as well.

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20. The method of Claim 19 in which an opportunism threshold function determines the further objects that are sent.

21. The method of Claim 20 in which the opportunism threshold changes if the device is on a roaming network.

22. The method of Claim 21 in which the opportunism threshold changes
5 depending on whether a cell loading threshold of the cell the device is located in is exceeded.

23. The method of Claim 21 in which the opportunism threshold is applied
consistently by device and server, with changes to the threshold communicated across
10 the network.

24. The method of Claim 21 in which the network operator can vary the opportunism threshold.

15 25. The method of Claim 1 in which the actual time of replication is a function of the state of the mobile device, the state of the network and the parameters.

26. A mobile device programmed with software that enables the device to replicate data to a server using the method of Claim 1.

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27. A server programmed with software that enables the server to replicate data to a mobile device using the method of Claim 1.

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